

# Music Technology Impact on Composition

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The technology used to record and distribute music has had a strong impact on the way music is composed.

## Reel-to-reel audio tape recording

Reel-to-reel audio tape recording was first developed in 1928, and eventually used tapes from 1/4" to 2" wide at speeds of 30" per second or halves of that speed, 15", 7.5", ... down to 1-7/8" per second. The main inconvenience of this medium was having to handle the magnetic tape manually, thread it through the machine, and start it on the receiving take-up reel. The machine was also very susceptible to dust and dirt. This technology allowed high quality recording for a long duration, the primary disadvantage being the bulk and vulnerability of the medium and the recorder.

Pre-recorded music on reel-to-reel tape was first done in the early 50s and peaked in the mid 60s. Consumer tapes were typically 7" in diameter and used 1/4" tape. They could record 45-90 minutes depending on tape speed. My dad had a reel-to-reel recorder, but I never figured out how to use it. I don't think we had a mic to be able to record on it.

The same technology was used for computer storage until the 1980s (1/2" magnetic tape), and wide multi-track tapes (1-2") were used for data collection as early as the 1950s.

## Vinyl

Vinyl records have come in speeds of 78, 45, and 33-1/3 rpm, and were first used in the 1930s.

The oldest are 78 rpm and were 10" in diameter, could only hold three minutes (3:00) per side. This is why many songs from the 1960s were very short – they had to fit on a 78! The earliest 78s were made of shellac instead of vinyl. They were displaced by LPs in the 1950s. I inherited one 78 from a great aunt, "Music Box Dancer."

A 45 rpm record is 7" in diameter, used for a single song on each side, with a capacity of 5:00 minutes per side. These were very popular to buy a song without paying for the whole album on an LP.

Nevertheless, many popular artists compose songs much longer than five minutes, so the 45 was useless for them.

A 33-1/3 rpm record, commonly called an LP or Long Playing record, is 12" in diameter and has a capacity of 23-25 minutes per side. Introduced in 1948, most albums were distributed on LPs through the 70s, then going down due to the CD, but resurging in the 2010s thanks to the purity of analog sound and use by DJs.

## 8-track

The 8-track tape or Stereo 8 was invented in 1964 and had a maximum capacity of 80-100 minutes of music in four tracks. The player reads two tracks at a time for stereo (left and right channels). The tapes were large, 5.24" by 4" and 0.8" thick. It gave way to the music cassette in the early 80s. When I bought a boombox in the early 80s, I had to choose between 8-track and cassette. The latter won.

The magnetic tape in an 8-track was in a loop, so it would play the content over and over again. The annoying part was a loud noise when it changed tracks. It was possible to record to an 8-track, but that technology predated me.

The other challenge was that each track was 20-25 minutes long, and it was annoying to change tracks in the middle of a song. Likewise an entire album could be no more than 40-50 minutes long, so tracks would have to be rearranged or deleted if the source was longer than that. Some classical recordings needed three tapes.

## Cassette

The music cassette, officially called a Compact Cassette, was invented in 1963 and held 30-60 minutes per side. Like vinyl, it has an A side and a B side. The magnetic tape was passed from one spool to another, so you had to flip the cassette over to play the other side. Like 8-tracks, it could be recorded onto. It faded with the increased popularity of compact discs (CDs) in the mid 90s. The magnetic tape in it is 0.15" wide and runs at 1-7/8" per second – a speed related to reel-to-reel recording!

Oddly it was first used for recording dictation, so the recording quality had to be improved for music distribution. For prerecorded music the tape length could be customized to avoid long segments of black tape on one side.

Much smaller than an 8-track, a cassette is 4 by 2.5 by 0.5" and made portable music much easier, such as in a boombox or a Sony Walkman. The longer duration of each side and smaller medium size made it overtake the 8-track.

## CD

The digital revolution came in the form of the Compact Disc or CD, which recorded music in binary form. It was created in 1982 but became popular around the late 80s. A CD is 4.7" in diameter and only 1.3 mm thick. It holds 700 MB of data which is about 80 minutes of stereo sound. The data is two channels, 16 bits per channel, 44.1 kHz sampling rate. For one minute that gives:

$$60 \text{ sec} * 2 \text{ channels} * 16 \text{ bit/channel} * 44,100 \text{ sample} * \text{sec}^{-1} * 1 \text{ Byte}/8 \text{ bit} = 10,584,000 \text{ Bytes}$$

$$1 \text{ MB} = 1024^2 \text{ Bytes} = 1,048,576 \text{ Bytes}$$

$$700 \text{ MB} / 10.094 \text{ MB/min} = 69.35 \text{ minutes}$$

Hmm, doesn't look quite right.

The CD medium is small but vulnerable to being scratched on the data side. Some two-sided CDs have been made, but that makes labeling very difficult.

Use of CDs for storing data became obsolete with higher capacity hard drives. A 22 TB hard drive is the capacity of 31,428 CDs. Music is still distributed on CDs, but high speed Internet connections make music streaming much more common for younger consumers.

The CD format makes a long composition usable, but it's fading from popular use.